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UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF ENTOMOLOGY
FOREST INSECT INVESTIGATIONS

FOREST INSECT CONDITIONS

in the
YELLOWSTONE NATIONAL PARK
Season of 1928

By

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INTRODUCTION

During the past five years it has been the practice to submit, at the close of each field season, a rather formal report covering the status of insect conditions within the Yellowstone National Park. In order to secure action on emergency situations, a large per cent of the information contained within this report was submitted during the season through informal memorandums, letters, conferences, etc. However, in order to consolidate and add to this information, it seems advisable to continue the practice of submitting these annual reports. Due to the previous submission of all important information, the preparation of this report has been delayed as other matters relative to appropriations, plans for control, etc., required more immediate attention. It is trusted that this delay has caused no inconvenience, as it could hardly have been avoided.

During the years 1925 to 1927 inclusive, the entomological work within the Yellowstone Park was under the direct supervision of Dr. H. E. Burke. Due to the demands for Dr. Burke's services in other

regions during the 1928 season, it was necessary to return the responsibility for the supervision of this work to the Coeur d'Alene Station. After an absence of three years the writer experienced some difficulty in picking up the many threads which Dr. Burke had been carrying. However, it is believed that all important situations were adequately covered.

STATUS OF INSECT OUTBREAKS

Lodgepole Needle Tyer (Eulia sp.)

Lodgepole Sawfly (Neodiprion sp.)

Reference is made to reports submitted by Dr. H. W. Burke for the description and seasonal history of these insects. During the 1924 season it was discovered that an outbreak of these two insects had been responsible for the destruction of a tremendous acreage of lodgepole pine at West Yellowstone. Under the assumption that the outbreak would continue, plans were immediately started for the protection of the aesthetic value of the highway within the Park boundary by spraying a strip of trees on each side of the road. This project was started during July, 1924, and repeated each season up to and including 1927. The spraying was very effective in killing all of the sawfly larvae within a day or two, but the larvae of the needle tyer were not destroyed until they emerged from the needles. When the trees are sprayed before the emergence of the larvae from the mined needles and the subsequent construction of nests, or needle tubes, into

which the spray oftentimes does not penetrate, the mortality of these insects is very high, with a correspondingly small amount of damage to the tree. Though the spraying was very effectively performed, it was necessary to repeat the operation each year as the area sprayed was reinfested each spring by adult insects flying in from untreated regions adjacent.

It seems apparent to the writer that the severity of this outbreak must have started to decrease during the 1925 season, for there seems to be little additional destruction of timber than that which was observed in 1924. There is very little sawfly defoliation to be found at this time, though the needle tyer is still present in some areas in a near-epidemic status.

During the latter part of June the writer visited the West Yellowstone area for the purpose of determining the necessity for the continuation of the spraying operation during the 1926 season. At that time a very careful examination was made of this area, and though a few eggs of both insects were found they were so scarce that it was believed the resulting damage would be of little importance. This examination included both the sprayed and unsprayed regions, and as there was little evidence of 1927 damage within the untreated areas, it was felt that the spraying was no longer necessary, and it was recommended that it be discontinued during the 1926 season. It was fully realized

that in the adoption of this recommendation there would undoubtedly be some small amount of damage to the trees along the roadside. However, it was apparent that this injury would be so slight that it would not be noticeable, or result in any permanent injury. This position was taken from the fact that there was very little evidence of 1927 injury to untreated trees, and that the severity of the outbreak was apparently dying down through the action of natural agencies.

This area was revisited during the latter part of August and at that time there was some needle tyer work to be found along the roadside between the gate and the three-mile post. Though some damage resulted from these attacks there was no permanent or noticeable injury. The data secured from this examination supported the recommendation relative to the need for spraying made earlier in the season. It is not expected that spraying will be necessary during the 1929 season, but an examination will be made during the latter part of June to determine this fact.

Spruce Budworm (*Cacoecia fumiferana* Clem.)

During the month of August an examination was made of the Crescent Hill area and the timber stands adjacent to Camp Roosevelt to determine if the spruce budworm was still active within these areas. Though a careful search was made no evidence of this insect was found, and it is believed that the severe outbreak which was present along the Yellowstone River some few years ago has practically disappeared.

However, the evidence of this outbreak can still be seen in the large areas of dead Douglas fir.

An examination of the budworm epidemic in the Cody Canyon, Shoshone National Forest, was made during the latter part of August. The situation which exists within this region is an extremely serious one and undoubtedly a heavy loss of timber will follow. Due to the inclemency of the weather during this examination it was impossible to make as extensive a reconnaissance as planned, but the severity and magnitude of the infestation were observed.

All insects that feed externally upon the foliage of trees, such as the spruce budworm, can be destroyed if their food is properly poisoned by spraying or dusting. However, the technique of spraying or dusting for the control of the spruce budworm has not been developed. Due to the habit which the overwintering larvae have of boring into the buds just as they are opening in the spring may offer some difficulties in determining the proper time to apply the poison. It would seem essential that some experimental spraying and dusting be conducted during the 1929 season, in order that the proper technique of application can be developed and protection given to trees of high commercial and aesthetic value. Plans have been completed for the institution of such experiments within the Cody Canyon during the months of June and July, 1929.

The thoughts of attempting the control of this epidemic by artificially spraying or dusting the host plants, while not impossible, offer rather a serious problem. The canyon walls are very steep and the floor is rough and rugged. The Shoshone River, which is a rather wide stream, separates the south side of the canyon from the road, which would seriously increase the physical difficulty of spraying or dusting from the ground. The topography of the country is so rough that it is possible that serious difficulties would be encountered in the dusting of the area from an airplane.

An outbreak of an unknown insect or disease had been previously reported as defoliating the lodgepole pine within the Bechler River drainage. This region was examined and much to the surprise of the writer the insect was found to be the spruce budworm. It has been previously known that this insect would attack practically every conifer when in association with Douglas fir or true fir, which were believed to be the preferred hosts of this insect. However, this is the first record which is available of this insect attacking and adapting itself to a pure stand of pine. It is possible that this insect may prove to be a variety of the spruce budworm.

The possibility of pure pine stands becoming an accepted host of this insect places its economic importance in a more serious light than before. It is hoped that during the coming season it will be possible to institute an adequate study of this insect in relation to its many host plants. This outbreak extends over a large area and the thought

of control seems nearly prohibitive, because of the expense involved. However, the physical difficulties of applying a spray from the ground or a dust from the air would not be as great as in the Cody Canyon, due to the more even topography of the terrain.

Douglas Fir Beetle (*Dendroctonus pseudotsugae*)

Numerous groups of Douglas fir trees killed by the Douglas fir beetle were observed throughout the area defoliated by the spruce budworm along the Yellowstone River. It is apparent that these beetles are spreading from this area of weakened trees into the un-defoliated regions adjacent. A few small groups of Douglas fir trees killed by this beetle were observed in the timber stands adjacent to Crescent Hill, where there had been no previous injury from the budworm. This is a condition which had been expected as practically all of the thousands of trees fatally weakened through budworm defoliation were being secondarily attacked by Douglas fir beetles. With the exhaustion of this supply of extremely favorable host material following the cessation of the budworm outbreak, it could be expected that the beetles would be forced to spread into the uninjured timber stands adjacent. The importance or seriousness of this spread of beetles into the areas uninjured through defoliation is rather hard to determine at this time. The resulting damage may prove to be negligible in character, or a serious outbreak may result. It is essential that this region be carefully watched and at the first indication of the occurrence of epidemic conditions, intensive control measures should be instituted.

The writer believes that the prevention of forest insect damage within our National Parks must be a matter of prevention rather than control. In following this policy all insect outbreaks should be treated while in their incipiency. One should regard all insect-infested trees as potential outbreaks, and prompt action taken to secure their treatment. However, the beetle attacks within the Douglas fir stands of Crescent Hill and adjacent territories offer a situation which must be viewed in a somewhat different light, for in this case an epidemic already exists. To treat these outlying spots of infested trees and disregard the heavy infestations within the defoliated area would be leaving the cause and attacking the effect. As long as this source of beetle supply exists there will be an annual reinfestation of trees within the undefoliated areas adjacent. Therefore, unless the outlying spots of infestation become too numerous, or develop into too severe a situation, it is recommended that no control measures be instituted until the source of reinfestation no longer exists. At that time by taking advantage of the natural factors which would tend to restore this outbreak to a normal status, artificial control measures should give satisfactory results.

An examination was made of the Douglas fir control project at Camp Roosevelt and adjacent areas. This work was rather carelessly done, as in the burning of the infested trees a large number of green, uninfested ones were scorched, which in every case were subsequently attacked by the Douglas fir beetle during the past season. The fact

that scorched Douglas fir trees immediately become potential bug trees must be remembered in all future control operations instituted against outbreaks of this insect. Under date of August 31 this situation was called to the attention of the Park Superintendent and the need for more careful burning of the infested trees emphasized.

Oregon Engraver Beetle (*Ina oregoni*)

The Oregon engraver beetle with other species of the same genera are considered as being, for the most part, secondary in importance. By being of secondary importance is meant that the normal host of the insect is a weakened, decadent tree, and that it does not as a rule attack healthy, living individuals. However, under certain favorable conditions such insects often occur in sufficient numbers to enable them to successfully attack and kill apparently healthy trees. Such conditions often arise through the creation of abnormal quantities of favorable host material, such as windfalls, operators' slash, fire-scорched trees, unpeeled logs and poles, etc. Such material favors the development of these insects and upon emergence, unless additional material is provided for them, they attack and destroy standing healthy trees adjacent. Fortunately, outbreaks of this kind are of rather short duration, and in a season or two the insects are reduced to an endemic status by natural means. However, during these short outbreaks rather large volumes of timber are often destroyed. Therefore, when economically possible trees infested with such insects should be

promptly located and treated. In this way it is possible that serious outbreaks may be prevented and the resulting loss reduced to a minimum.

In considering the prevention of this class of damage to the trees within our National Park, our thoughts should first be directed towards the breeding of these insects within abnormal quantities of attractive host material which is often responsible for such outbreaks. Logging or wood-cutting slash, trees scorched in burning brush, freshly constructed cabins of unpeeled logs, unpeeled logs and poles left during road and trail construction, etc., are factors which contribute towards such abnormal insect conditions, and can often be prevented. Through the elimination of these factors a large per cent of the damage resulting from the attacks of such secondary insects as the Oregon engraver can be reduced to a minimum.

Near Roaring Mountain several groups of small lodgepole pine trees were found to be heavily infested with the Oregon engraver beetle. The source of these local and sporadic outbreaks was undoubtedly the clearing of the debris on the forest floor along the main highway, which resulted in the creation of a small amount of slash and the scorching of a rather large number of trees through careless burning. As the insects were in a new adult stage at that time, it was recommended that these trees be felled and burned immediately in order to destroy them before emergence occurred.

At the Thumb there was a group of ten fair-sized lodgepole pine which were heavily infested with the Oregon engraver. This infestation

undoubtedly resulted from a freshly constructed lavatory which had been made of unpeeled logs during the 1927 season, as these logs had been attacked subsequent to the construction of the building. It was recommended that these trees be felled and burned at once, as the insect broods were well developed and the mature adults would start to emerge within a few days. With the trees at both Roaring Mountain and the Thumb, there was a distinct fading of the foliage which made their location a rather simple matter.

Secondary Insects

Within the Park, as within any forest, there are many insects which are to be found attacking the different parts of trees. Such insects as the pine leaf scale, aphis, bark weevils, etc., though often responsible for the death of scattered trees, seldom become of any great economic importance. It is well, however, to keep a rather close check of such insects, as under favorable conditions serious epidemics of what are usually called secondary species, can and do occur. The institution of control measures for the treatment of trees infested with such insects is not recommended for normal situations. However, around camp sites, geyser formations, etc., it is recommended that, inasmuch as the dead trees are always removed for sanitary and aesthetic reasons, a careful watch be maintained of such areas and infested trees be felled and burned before the developing broods of insects emerge. It is possible that in this manner the life of many trees can be prolonged for a number of years.

Protection of Trees Around Camp Sites

The death of many trees around camp sites, which die from the results of various physical injuries received from campers, has resulted in the expression "tourist killed". Though in many cases trees weakened in this manner are attacked by barkbeetles, the insects cannot be considered as primarily responsible for the death of the tree. Usually such species of barkbeetles are considered as being of secondary importance, attacking only weakened and decadent trees. However, under favorable conditions green, healthy trees are sometimes attacked and killed. Inasmuch as for aesthetic and sanitary reasons all dead trees are removed from camp sites, it is recommended that all such weakened and dying trees which harbor broods of barkbeetles be destroyed before the mature insects emerge. By following this practice it is possible that some weakened trees which would have otherwise been killed may be saved, or even small local and sporadic outbreaks prevented.

It would seem that the best method to follow for the elimination of this loss within camp sites, would be to take all precautionary measures to prevent mechanical injury to the trees and to keep them in a thrifty growing condition. If one will compare the trees within a camp site to the natural conditions under which the trees are growing within a forest, the unfavorable circumstances under which they are obliged to compete for existence will be easily recognized. The duff and humus are removed and the soil becomes dry and solid. The roots are exposed and the bark worn from the upper surface. The base is

peeled and scraped by automobile bumpers and fenders, and from the combined effects of all these unfavorable conditions the trees soon become weakened and are an easy prey to the attacks of secondary bark-beetles. The practices of piling dirt from excavations, etc., around the base of the trees should be discouraged. Such conditions prevent the necessary air from reaching the root system and death is nearly inevitable. Where such action cannot be avoided the trees should be removed beforehand.

It is fully recognized that it will be practically impossible to eliminate all such mechanical or physical injuries from camp sites, and as a result the weakened trees will often be attacked and killed by insects. The only policy which can be followed is the prompt location and treatment of all infested trees in the hope that the loss will be reduced to a minimum and local outbreaks prevented.

A few trees of this character were found in the camp ground at Old Faithful and Yellowstone Lake, which were marked for treatment.

Geyser Formations

The protection of trees around geyser formations from insect attack offers a very difficult problem. The trees which are usually attacked are badly weakened and decadent individuals, which become an easy prey for secondary barkbeetles. The site under which these trees are growing is an extremely unfavorable one. There is no humus, the

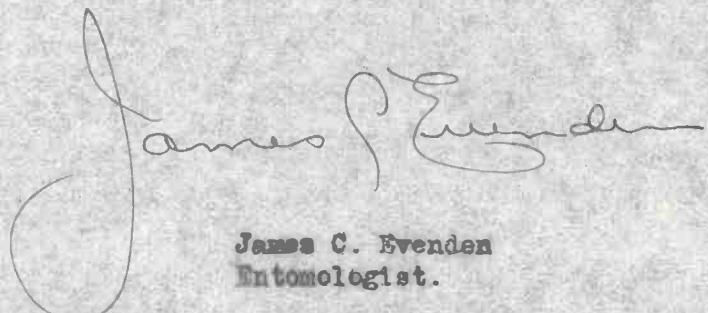
soil is bare and packed, which naturally produces a slow-growing and decadent tree. It is not known what effect the fumes, water, and gases from the formations have upon the growth of such trees, but it is not assumed to be a favorable one.

The difficulty of this problem rests in the fact that it would seem to be impossible to keep the trees in a thrifty growing condition so as to make them more resistant to insect attack. The only plan which can be followed for the elimination of this loss is to promptly locate and treat all infested trees which will tend to reduce it to a minimum. However, in such action the control measures instituted are but the elimination of the effect rather than the cause, as a large per cent of the trees so treated would have died within a few years had no insect attack occurred. We must therefore consider the institution of control measures for such situations as a means of reducing to a minimum what would seem to be an inevitable loss, and spreading over a period of years a destruction which might have otherwise occurred in a season or two. Control measures instituted in such areas, regardless of how thoroughly and efficiently performed, cannot be expected to eliminate further damage. Within the adjacent forests these insects are always present in windfalls, broken tops of trees, slash operations, etc., and are easily attracted to such decadent trees as are found around all geyser formations.

RECOMMENDATIONS FOR 1929 SEASON

1. Recommendations were made during the summer for the treatment of Douglas fir trees at Camp Roosevelt which are infested with the Douglas fir beetle, and groups of lodgepole pine infested with Ips oregoni at Roaring Mountain and Mud Volcano. This work should have been instituted and completed last season.
2. A careful check should be made of the sawfly and needle tyer area at West Yellowstone during the latter part of June, 1929. Though it is apparent that this outbreak has died down, there is always the possibility of it developing into another serious outbreak.
3. The outbreak of the Douglas fir beetle at Camp Roosevelt should be carefully examined and any reinfestation treated during the fall of 1929.
4. All camp sites and geyser formations should be examined and all trees infested with Ips, or other secondary insects, marked for treatment. This recommendation must be accepted with the realization that such losses cannot be eliminated from these areas, but by the treatment of these trees it is hoped to keep the loss down to a minimum amount. This position is taken on the assumption that as the dead trees are removed from all such areas, they may as well be treated before the insects emerge, and some good accomplished.
5. A rather careful reconnaissance should be made of the entire Park for the purpose of locating and treating any mountain pine beetle

(*Dendroctonus monticolus*) infestation in lodgepole pine. This precautionary measure is recommended because of the severe outbreak of this insect which now exists within the lodgepole pine stands to the northwest. This insect has demonstrated its ability to fly extremely long distances, and it is only by keeping a close watch of the areas in advance of this epidemic that new outbreaks can be located and checked while still in their incipiency. Such a reconnaissance will of necessity be in the nature of a red-top survey. All lodgepole pine areas should be viewed from ridges, rock outcroppings, lookouts, etc., and red-topped lodgepole pine trees counted and their approximate location mapped. As a red-top tree viewed during the summer represents the previous year's attack, it is necessary to make a more intensive examination of all areas where red-tops are observed, in order to determine the ratio which exists between them and the new attacks of the present season.



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